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CAMBOARD Electronics



KRAMER ELECTRONICS LTD.

# USER MANUAL

MODEL:

**850**

Pattern Generator

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P/N: 2900-300033 Rev 1

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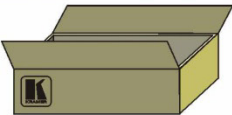
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# 850 Quick Start Guide

This page guides you through a basic installation and first-time use of your **850**. For more detailed information, see the **850** user manual. You can download the latest manual at <http://www.kramerelectronics.com>.

## Step 1: Check what's in the box

- ☒ **850** Pattern Generator
- ☒ 1 power adapter (5V DC input)
- ☒ 4 rubber feet
- ☒ 1 Quick start guide
- ☒ 1 User Manual



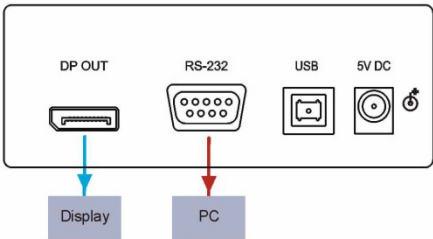
Save the original box and packaging materials in case your Kramer product needs to be returned to the factory for service.

## Step 2: Install the 850

Stick the rubber feet to the bottom of the device and place on stable surface.

## Step 3: Connect the inputs and outputs

Always switch off the power to the display before connecting it to your **850**.



For best results, we recommend that you always use Kramer high-performance cables to connect AV equipment to the **850**.

## Step 4: Connect the power

Connect the 5V DC power adapter to the **850** and plug the adapter into the mains electricity. Switch on the power to the display.



## Step 5: Operate the 850

Set the parameters using the front panel buttons and/or the Controller Software.

RESOLUTION  
PATTERN  
COLOR SPACE  
DELAY  
AUDIO SAMPLING FREQUENCY



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# 1 Introduction

Welcome to Kramer Electronics! Since 1981, Kramer Electronics has been providing a world of unique, creative, and affordable solutions to the vast range of problems that confront the video, audio, presentation, and broadcasting professional on a daily basis. In recent years, we have redesigned and upgraded most of our line, making the best even better!

Our 1,000-plus different models now appear in 11 groups that are clearly defined by function: GROUP 1: Distribution Amplifiers; GROUP 2: Switchers and Matrix Switchers; GROUP 3: Control Systems; GROUP 4: Format/Standards Converters; GROUP 5: Range Extenders and Repeaters; GROUP 6: Specialty AV Products; GROUP 7: Scan Converters and Scalers; GROUP 8: Cables and Connectors; GROUP 9: Room Connectivity; GROUP 10: Accessories and Rack Adapters and GROUP 11: Sierra Products.

Congratulations on purchasing your Kramer MultiTOOLS® **850** DisplayPort *Pattern Generator*, which is ideal for the following typical applications:

- As a diagnostic tool in AV setups
- Testing and adjusting flat panel LCD displays, projectors, plasmas and DisplayPort cables
- Testing the refresh rates of LCD displays by using the motion patterns

## 2 Getting Started

We recommend that you:

- Unpack the equipment carefully and save the original box and packaging materials for possible future shipment
- Review the contents of this user manual  
Use Kramer high performance, high resolution cables



Go to <http://www.kramerelectronics.com> to check for up-to-date user manuals, application programs, and to check if firmware upgrades are available (where appropriate).

### 2.1 Achieving the Best Performance

To achieve the best performance:

- Use only good quality connection cables to avoid interference, deterioration in signal quality due to poor matching, and elevated noise levels (often associated with low quality cables)
- Avoid interference from neighboring electrical appliances that may adversely influence signal quality
- Position your Kramer **850** DisplayPort *Pattern Generator* away from moisture, excessive sunlight and dust



Go to <http://www.kramerelectronics.com> to check for up-to-date user manuals, application programs, and to check if firmware upgrades are available (where appropriate).



**Caution:** No operator serviceable parts inside the unit

**Warning:** Use only the Kramer Electronics input power wall adapter that is provided with the unit

3

Overview

The **850** is a high performance, DisplayPort video test pattern generator. It can generate 32 preset patterns at 16 popular, predefined, computer and HD video resolutions and seven user-defined resolutions, including several unique patterns incorporating motion.

In particular, the MultiTOOLS<sup>®</sup> **850** features:

- A DisplayPort output
- Five dual-function and two single-function control buttons
- A two-digit 7 segment display
- An onboard EPROM that saves the last setting

3.1

Defining the 850 DisplayPort Pattern Generator

[Figure 1](#) defines the front panel of the **850**.

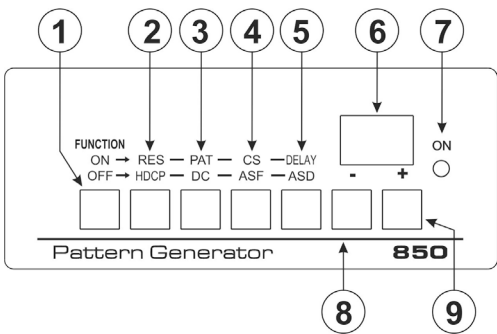


Figure 1: 850 Pattern Generator Front Panel

| 850 Front Panel Features |                  |          |                                                                                                                                                                                                                                                                               |
|--------------------------|------------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| #                        | Feature          |          | Function                                                                                                                                                                                                                                                                      |
| 1                        | FUNCTION Buttons | ON/OFF   | Press to toggle between the top row and bottom row functions. Button LED lights when on. When on, the top row of functions are enabled (RES, PAT, CS and Delay). When off, the bottom row of functions (HDCP, DC, ASF and ASD) are enabled (see <a href="#">Section 5.1</a> ) |
| 2                        |                  | RES/HDCP | Press to select either the Resolution (when the ON/OFF button is on) or HDCP functions (when the ON/OFF button is off)                                                                                                                                                        |
| 3                        |                  | PAT/DC   | Press to select either the Pattern (when the ON/OFF button is on) or Color Depth functions (when the ON/OFF button is off)                                                                                                                                                    |

| 850 Front Panel Features |                           |           |                                                                                                                                                                                                        |
|--------------------------|---------------------------|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| #                        | Feature                   |           | Function                                                                                                                                                                                               |
| 4                        |                           | CS/ASF    | Press to select either the Color Space (when the ON/OFF button is on) or Audio Sample Frequency functions (when the ON/OFF button is off)                                                              |
| 5                        |                           | DELAY/ASD | Press to select either the Delay (when the ON/OFF button is on) or Audio Sample Data functions (when the ON/OFF button is off)                                                                         |
| 6                        | 2-digit 7-segment Display |           | Indicates the current setting. The display flashes if there is a problem communicating with the display, for example, if the display does not support HDCP or does not support the selected resolution |
| 7                        | ON LED                    |           | Lights red when the device receives power                                                                                                                                                              |
| 8                        | – Button                  |           | Press to step down through the list of available values                                                                                                                                                |
| 9                        | + Button                  |           | Press to step up through the list of available values                                                                                                                                                  |

Figure 2 defines the rear panel of the 850.

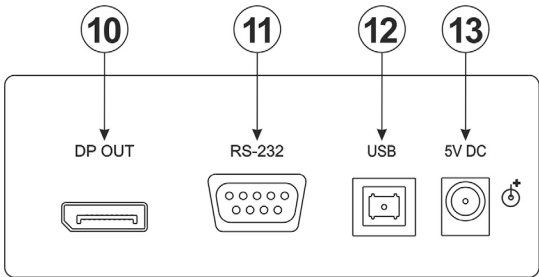


Figure 2: 850 Pattern Generator Rear Panel

| 850 Rear Panel Features |                              |                                                                                            |
|-------------------------|------------------------------|--------------------------------------------------------------------------------------------|
| #                       | Feature                      | Function                                                                                   |
| 10                      | DP OUT Connector             | Connect to the DisplayPort acceptor (see <a href="#">Section 4</a> )                       |
| 11                      | RS-232 9-pin D-sub Connector | Connect to the serial port on a PC for remote control (see <a href="#">Section 4.1.1</a> ) |
| 12                      | USB Connector                | Connect to a USB port on a PC for remote control                                           |
| 13                      | 5V DC Connector              | Connect to the power adapter                                                               |

## 4 Connecting the 850



Always switch off the power to any device before connecting it to your **850**. After connecting your **850**, connect its power and then switch on the power to the device.

To connect the **850** as illustrated in the example in [Figure 3](#):

1. Connect the DP OUT connector to a DisplayPort acceptor (for example, a flat panel LCD display).
2. Optional—connect a PC to control the **850** via the RS-232 or USB port.
3. Connect the power adapter to the 5V DC socket and to the mains electricity.

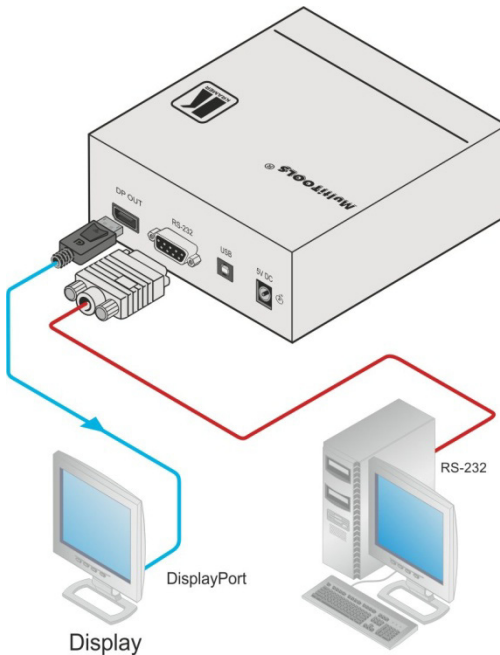


Figure 3: Connecting the 850 Pattern Generator

## 4.1 Connecting a PC

You can connect to the **850** via the RS-232 serial and via the USB port.

### 4.1.1 Connecting a PC via the RS-232 Serial Port

You can connect to the **850** via an RS-232 connection using, for example, a PC. Note that a null-modem adapter/connection is not required.

**To connect to the product via RS-232:**

- Connect the RS-232 9-pin D-sub rear panel port on the product unit via a 9-wire straight cable (only pin 2 to pin 2, pin 3 to pin 3, and pin 5 to pin 5 need to be connected) to the RS-232 9-pin D-sub port on your PC

### 4.1.2 Connecting a PC via the USB Port

To connect the **850** via a USB port you must download and install the USB driver and **850** Control application.

**Note:** The driver only works on 32-bit systems.

**To install the USB driver and Control Application:**

1. Navigate to the Kramer Electronics Web site (<http://www.kramerelectronics.com>) and search for the product **850**.
2. Click on the **Downloads** tab.
3. Download the **850** Windows USB Driver.
4. Download the **850 Control Application** to a designated folder on your computer.
5. Extract the compressed USB driver file to your designated folder. Two files are extracted, a **.inf** and a **.sys** file.
6. Connect the USB cable between your computer and the **850**.
7. Connect the power supply to the **850**.

8. After a few seconds the **Found New Hardware** message appears as shown in [Figure 4](#).



Figure 4: Found New Hardware Wizard Window

9. Click on the **No, not this time** radio button.
10. Click **Next**.
11. Select **Install from a list or specific location (Advanced)** as shown in [Figure 5](#).

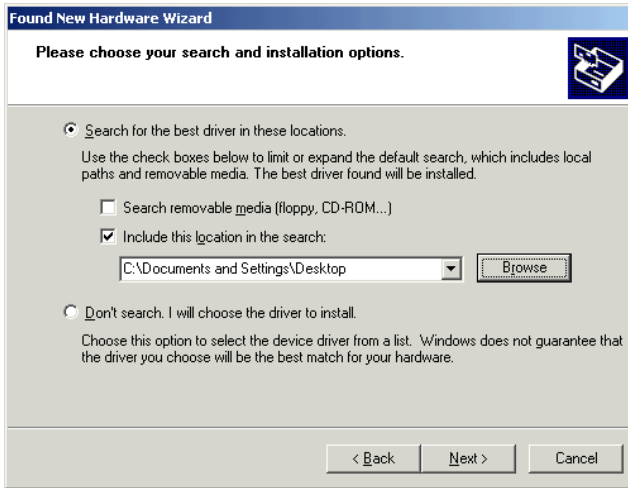


Figure 5: File Location Selection Window

12. Click **Next**.
13. Select **Search for the best driver in these locations**.
14. Check **Include this location in the search**. Browse to your previously designated folder.
15. Click **Next**.
16. Select the file *atm6124.inf*
17. The warning **This driver is not digitally signed!** appears.
18. Click **Next**.
19. Ignore the warning. Click **Continue Anyway**.
20. In the **Insert disk** window, click **OK** as shown in [Figure 6](#).

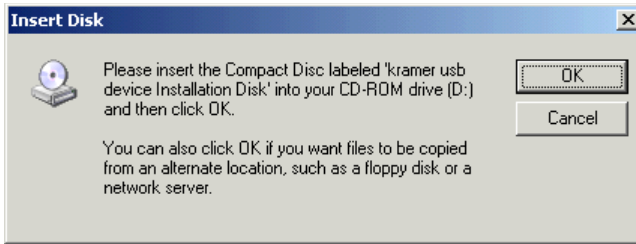


Figure 6: Insert Disk Window

21. Select the file *atm6124.sys* and click **Open**.

The driver installs and a success message is displayed. The USB driver has been successfully installed and you can install the **850 Control Application**.

22. Navigate to the designated folder to which you downloaded the *Control Application*.

23. Double-click the file *setup.exe* from this folder or from the distribution media included with the **850**.

The *Control Application* has been successfully installed.

5

Operating the 850 Pattern Generator

The **850** can be operated using the front panel buttons (see [Section 5.1](#)) and the **850 Control Application** (see [Section 5.2](#)).

The **850 Control Application** is available as a free download from <http://www.kramerelectronics.com>).

The following output video resolutions are supported.

| Resolution Values |                          |    |                          |
|-------------------|--------------------------|----|--------------------------|
| #                 | Resolution               | #  | Resolution               |
| 1                 | VGA 640 x 480 @60Hz      | 13 | 2048 x 1536 @60          |
| 2                 | SVGA 800 x 600 @60Hz     | 14 | 1856 x 1392 @60          |
| 3                 | XGA 1024 x 768 @60Hz     | 15 | 2560 x 1440 @60          |
| 4                 | 1280 x 720 @60Hz         | 16 | 2560 x 1600 @60          |
| 5                 | 1280 x 1024 @60          | 17 | User defined             |
| 6                 | WSXGA+ 1680 x 1050 @60Hz | 18 |                          |
| 7                 | SXGA 1280 x 1024 @75Hz   | 19 |                          |
| 8                 | HD 1920 x 1080 @60Hz     | 20 |                          |
| 9                 | WUXGA 1920 x 1200 @60Hz  | 21 |                          |
| 10                | UXGA 1600 x 1200 @60Hz   | 22 |                          |
| 11                | 2048 x 1280 @60          | 23 |                          |
| 12                | 2048 x 1152 @60          | 24 | Output native resolution |

The following video patterns are supported.

| Pattern Values |                  |    |                  |
|----------------|------------------|----|------------------|
| #              | Pattern          | #  | Pattern          |
| 1              | 100% Color bar   | 17 | Square           |
| 2              | 75% Color bar    | 18 | White dot        |
| 3              | Gray bar         | 19 | Alternate pixels |
| 4              | Red screen       | 20 | White HScroll    |
| 5              | Green screen     | 21 | White VScroll    |
| 6              | Blue screen      | 22 | Multiburst       |
| 7              | Yellow screen    | 23 | Vertical split   |
| 8              | Cyan screen      | 24 | Horizontal split |
| 9              | Magenta screen   | 25 | Red ramp         |
| 10             | Gray screen      | 26 | Green ramp       |
| 11             | White screen     | 27 | Blue ramp        |
| 12             | RGB ramp         | 28 | Bounce           |
| 13             | Black screen     | 29 | Window           |
| 14             | Crosshatch black | 30 | White border     |
| 15             | Crosshatch green | 31 | Target circle    |
| 16             | Crosshatch blue  | 32 | Moving ball      |

The following video and audio output options are supported.

| Parameter    | Front Panel | Output Settings Values                           |
|--------------|-------------|--------------------------------------------------|
| Delay        | Delay       | Sets the delay before changes are implemented    |
| HDCP         | HDCP        | On, Off                                          |
| Color Space  | CS          | RGB, YUV 444, YUV 422, Auto                      |
| Color Depth  | DC          | 24 bit, 30 bit, 36 bit, Auto                     |
| Audio Sample | ASF         | 44kHz, 48kHz, 88kHz, 96kHz, 176kHz, 192kHz, Auto |
| Audio Bit    | ASD         | 16 bit, 20 bit, 24 bit, Auto                     |

### 5.1 Operating the 850 Using the Front Panel Buttons

To activate the top row of functions (RES, PAT, CS and DELAY):

- Press the Function ON/OFF button (the button LED lights)

To activate the bottom row of functions (HDCP, DC, ASF and ASD):

- Press the Function ON/OFF button again (the button LED no longer lights)

To select a function and modify the value, for example, to select a specific pattern:

1. Press the **Function** button.  
The button lights to indicate the top row of functions (ON) is active.
2. Press the **PAT/DC** button.  
The button lights to indicate that the Pattern function is active.
3. Press the **+** or **–** button to cycle through the list of available patterns until the required pattern is displayed on the 7-segment display.

**Note:** The display flashes if there is a problem communicating with the display, for example, the display does not support HDCP or does not support the selected resolution.

## 5.2 Operating the 850 Using the Control Application

The **850 Control Application** is a PC-based program which lets you program and control the device.

To use the **850 Control Application** you must download and install the USB driver and the **850 Control Application**.

### 5.2.1 Connecting to the Device

To connect to the device:

1. Run the *Control Application* by clicking **Start > Programs > Kramer Electronics > 850**.
2. Click the **Connect** button.

The **Connection Method** window is displayed as shown in [Figure 7](#).

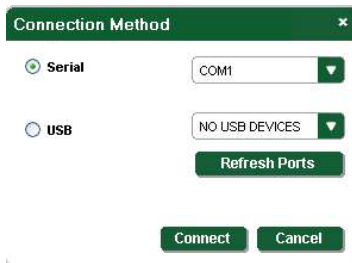


Figure 7: Connection Method Window

3. Select the required connection method (via a serial or USB connection) by clicking the relevant radio button.
4. For a serial connection, select the required Com port from the drop-down list.
5. For a USB connection, select the required USB device from the drop-down list.

To view an up-to-date list of available USB ports, press the **Refresh Ports** button.

**Note:** If the drop-down list shows **No USB Devices**, then either you have not installed the USB driver (see [Section 4.1.2](#)) or the installation was not successful.

6. Click **Connect**.

If the connection is not successful, a Timeout error message appears as shown in [Figure 8](#). If the connection is successful, the main window shown in [Figure 9](#) appears.



Figure 8: Connection Error Message

### 5.2.2 Controller Software Main Window

The Controller Software Main Window is shown in [Figure 9](#).

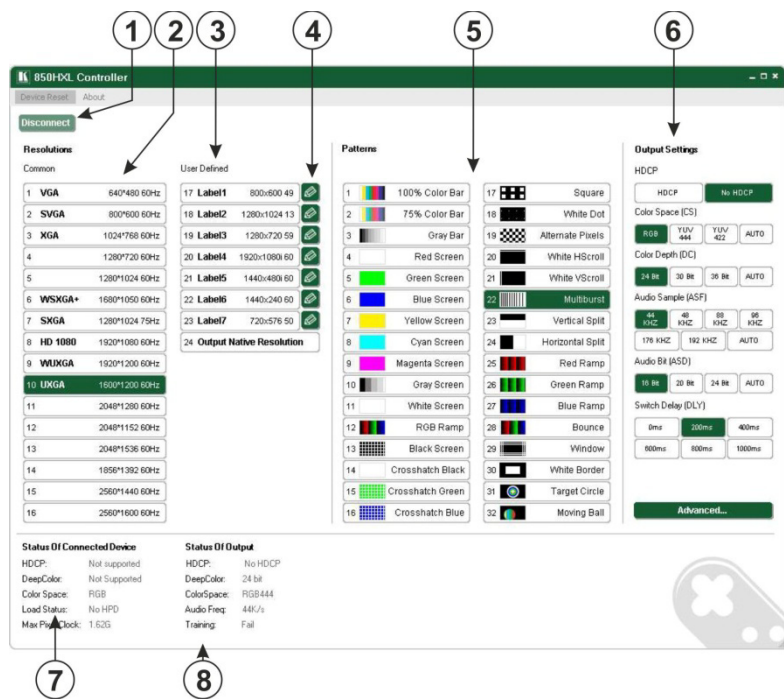


Figure 9: Controller Software Main Window

| 850 Controller Software Main Window |                                      |                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| #                                   | Feature                              | Function                                                                                                                                                                                                                                                                                                            |
| 1                                   | CONNECT Button                       | Press to connect to a device (see <a href="#">Section 5.2.1</a> )                                                                                                                                                                                                                                                   |
| 2                                   | Resolutions                          | COMMON Buttons                                                                                                                                                                                                                                                                                                      |
| 3                                   |                                      | USER DEFINED Buttons                                                                                                                                                                                                                                                                                                |
| 4                                   | User Defined Resolution Edit Buttons | Press to edit the relevant user defined output resolution                                                                                                                                                                                                                                                           |
| 5                                   | Patterns Buttons                     | Press to select an output pattern                                                                                                                                                                                                                                                                                   |
| 6                                   | Output Settings Buttons              | Press to modify the output settings:<br>Delay—Sets the delay before changes are implemented<br>HDCP—HDCP, No HDCP<br>Color Space—RGB, YUV 444, YUV 422, Auto<br>Color Depth—24 bit, 30 bit, 36 bit, Auto<br>Audio Sample—44kHz, 48kHz, 88kHz, 96kHz, 176kHz, 192kHz, Auto<br>Audio Bit—16 bit, 20 bit, 24 bit, Auto |
| 7                                   | Status of Connected Display          | Information on the currently connected display                                                                                                                                                                                                                                                                      |
| 8                                   | Status of Output                     | Information on the currently selected output settings                                                                                                                                                                                                                                                               |

### 5.2.3 Editing User Defined Resolutions

To edit a user defined resolution:

1. Click the required user defined resolution edit button .

The **User Defined** Window appears with the **CEA 861 Standard** Tab selected as shown in [Figure 10](#).

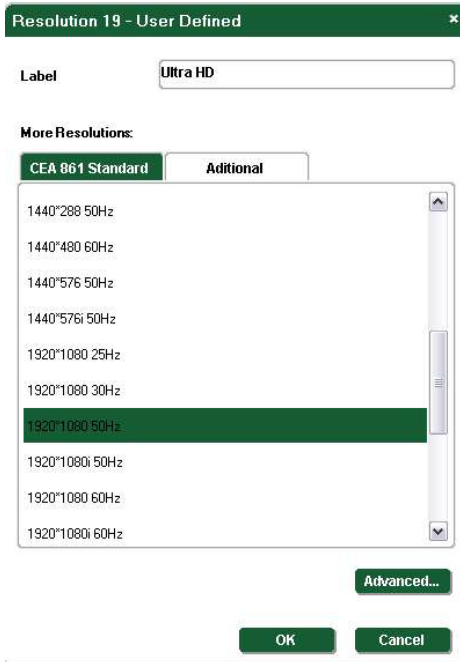


Figure 10: User Defined Resolution Window–Standard Tab

2. In the **Label** field, enter the required label for the button.
3. Click one of the resolutions to select the required resolution.
4. Click **OK** to save the resolution settings or click the **Additional** button to edit the aspect ratio and specific resolution.

The **Additional** Tab is displayed as shown in [Figure 11](#).



Figure 11: User Defined Resolution Advanced Window—Additional Tab

5. Select the required aspect ratio and resolution.
6. Click **OK** to save the additional parameters or click the **Advanced** button to edit the timing parameters and EDID values.  
The **Advanced** Window appears with the **Timing Parameters** tab selected as shown in [Figure 12](#).

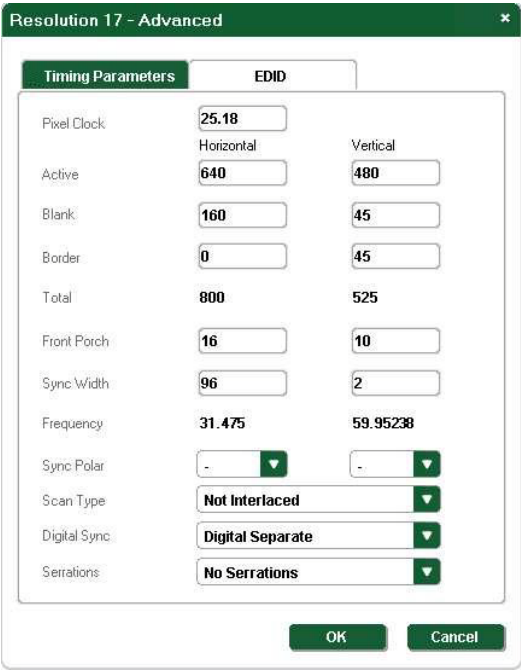


Figure 12: User Defined Resolution Advanced Window–Timing Parameters Tab

- 7. Edit or select the required resolution timing values, such as, Pixel Clock and Digital Sync.
- 8. Click **OK** to accept the changes or click on the **EDID** tab to edit the EDID values.

The **EDID** tab is displayed as shown in [Figure 13](#).

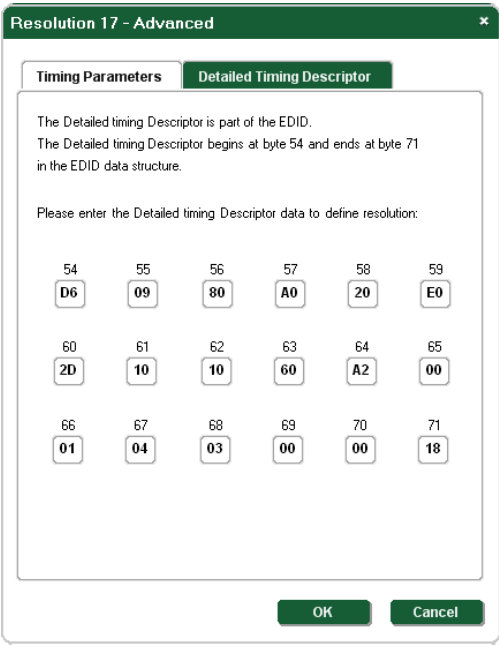


Figure 13: User Defined Resolution Advanced Window–EDID Tab

- 9. Edit the EDID values as required.
- 10. Click **OK** to save the values.

6

Technical Specifications

|                                                                                                                                        |                                                                                                                                                       |
|----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| OUTPUT:                                                                                                                                | 1 DisplayPort connector                                                                                                                               |
| CONTROL:                                                                                                                               | Five dual-function and two single function front panel buttons,<br>Remote control via USB on a USB connector and RS-232 on a<br>9-pin D-sub connector |
| POWER SOURCE:                                                                                                                          | 5V DC, 670mA                                                                                                                                          |
| OPERATING<br>TEMPERATURE:                                                                                                              | 0° to +55°C (32° to 131°F)                                                                                                                            |
| STORAGE<br>TEMPERATURE:                                                                                                                | -45° to +72°C (-49° to 162°F)                                                                                                                         |
| HUMIDITY:                                                                                                                              | 10% to 90%, RHL non-condensing                                                                                                                        |
| DIMENSIONS:                                                                                                                            | 10.7cm x 10.0cm x 4.4cm (4.2" x 3.9" x 1.7") W, D, H                                                                                                  |
| WEIGHT:                                                                                                                                | 0.4kg (0.88lbs) approx.                                                                                                                               |
| ACCESSORIES:                                                                                                                           | Power supply                                                                                                                                          |
| OPTIONS:                                                                                                                               | RK-1 Universal rack adapter                                                                                                                           |
| Specifications are subject to change without notice at <a href="http://www.kramerelectronics.com">http://www.kramerelectronics.com</a> |                                                                                                                                                       |

7

Communication Parameters

| RS-232     |      |
|------------|------|
| Baud Rate: | 9600 |
| Data Bits: | 8    |
| Stop Bits: | 1    |
| Parity:    | None |

8

Serial Protocol

The **850** can be controlled via the serial port using the commands described in this section.

8.1

Command Format

Commands must be in the following format:

*0xEB, address, command, length of data, data 1,..., data n, checksum*

where the following table describes the command components.

| Command Component | Description                                                                                                                                                                                                                                                                                                                           |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0xEB              | Fixed command start byte                                                                                                                                                                                                                                                                                                              |
| address           | Device address. This is always 0x90 for the 850                                                                                                                                                                                                                                                                                       |
| command           | Command to be sent (see <a href="#">Section 8.3</a> )                                                                                                                                                                                                                                                                                 |
| length of data    | How many bytes sent/received (from data 1 to data n)                                                                                                                                                                                                                                                                                  |
| data 1, data n    | One or more command variables within the range 0x01 to 0xFA and excluding 0xEB                                                                                                                                                                                                                                                        |
| checksum          | Optional—Checks whether the sending/receiving frame is valid.<br>Check sum = Address + Command + Data length + Data 1+...+Data n<br>For example, EBH, 90H, 01H, 01H, F3H, 85H<br>Check sum = 90H + 01H + 01H + F3H = 185H<br><b>Note:</b> The checksum gets the low 8 bits, for example, if the check sum = EBH, then check sum = 14H |

8.2

Device Response

The device responds as follows:

*0xEB, 0x90, command, 0x01, answer, check sum*

where *answer* is one of the values described in the following table.

| Command Component | Description                                                                                                                       |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| 0xF1              | Either:<br>–the device received the wrong address and returns no response<br>–the device gets information about Errors and Alarms |
| 0xF2              | The data is out of range. The command is not executed                                                                             |
| 0xF3              | The device is currently controlled by the buttons. The command is not executed                                                    |
| 0xF7              | The data length is incorrect. The command is not executed                                                                         |
| 0xFC              | The data is out of range. The command is not executed                                                                             |

8.3

Commands

The commands listed below are supported by the **850**.

**Note:** The checksum is required at the end of the send/receive command as shown in [Section 8.1](#). If a checksum is not included in a sent command, the device will not respond.

8.3.1

Get Device Address and Software Version

| Command | Send/Receive                                                                                         | Data                             |
|---------|------------------------------------------------------------------------------------------------------|----------------------------------|
| 0x00    | 0xEB, 0x00, 0x00, 0x01, 0xFF, checksum<br><br>0xEB, [address], 0x00, 0x02, [version], 0x00, checksum | 0xFF can be any data except 0xEB |

8.3.2

Set Output Encryption or Decryption

| Command | Send/Receive                                                                             | Data                                                                                         |
|---------|------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
| 0xE3    | 0xEB, 0x00, 0xE3, 0x01, data1, checksum<br><br>0xEB, address, 0xE3, 0x01, 0xFA, checksum | data1: <ul style="list-style-type: none"><li>0 = encryption</li><li>1 = decryption</li></ul> |

8.3.3

Get Device Status

| Command | Send/Receive                                                                                              | Data                                                                                                                                                                                                                                                     |
|---------|-----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0xE4    | 0xEB, address, 0xE4, 0x01, 0x00, checksum<br><br>0xEB, address, 0xE4, 0x08, data1, ....., data8, checksum | data1: reserved<br>data2: reserved<br>data3: output encryption status: <ul style="list-style-type: none"><li>0 = encryption</li><li>1 = decryption</li></ul> data4: reserved<br>data5: reserved<br>data6: reserved<br>data7: reserved<br>data8: reserved |

8.3.4 Set Output Status

| Command | Send/Receive                                                                                       | Data                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------|----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0xE6    | 0xEB, address, 0xE6, 0x02, data1, data2, checksum<br><br>0xEB, address, 0xE6, 0x01, 0xFA, checksum | data 1: <ul style="list-style-type: none"><li>• 0x00: reserved</li><li>• 0x01: RESOLUTION_INDEX</li><li>• 0x02: PATTERN_INDEX</li><li>• 0x03: DEEPCOLOR_MODE</li><li>• 0x04: COLORSPACE_MODE</li><li>• 0x05: reserved</li><li>• 0x06: AUDSAMPLE_INDEX</li><li>• 0x07: AUDBIT_INDEX</li><li>• 0x08: AUDCHANNEL_INDEX</li><li>• 0x09: BITRATE_INDEX</li><li>• 0x0A: OUT_LANE_INDEX</li><li>• 0x0B: OUT_ENHFRAMING_INDEX</li><li>• 0x0C: OUT_DELAY</li><li>• 0x0D: training</li></ul> data 2: <ul style="list-style-type: none"><li>• reserved</li><li>• from 0x00 to 0x17. (24 Resolutions)</li><li>• from 0x00 to 0x1f. (32 Patterns)</li><li>• 0 = auto, 0x18 = 24bit, 0x1e = 30bit, 0x24 = 36bit</li><li>• 0 = auto, 1 = RGB444, 2 = YUV444, 3 = YUV422</li><li>• reserved</li><li>• 0 = auto, 1 = 44k, 2 = 48k, 3 = 88k, 4 = 96k, 5 = 176k, 6 = 192k</li><li>• 0 = auto, 0x10 = 16bit, 0x14 = 20bit, 0x18 = 24bit</li><li>• 0 = auto, 1 = turn off, 2 = 2 channels, ....., 8 = 8 channels</li><li>• 0 = auto, 1 = 1.62G, 2 = 2.7G</li><li>• 0 = auto, 1 = 1 channel, 2 = 2 channels, 4 = 4 channels</li><li>• 0 = auto, 1 = not supported, 2 = supported</li><li>• 0 = 0ms, 1 = 200ms, 2 = 400ms, 3 = 600ms, 4 = 800ms, 5 = 1000ms</li><li>• 0 = training again</li></ul> |

8.3.5 Get Output Status

| Command | Send/Receive                                                                                           | Data                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------|--------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0xE7    | 0xEB, address, 0xE7, 0x01, 0x00, checksum<br><br>0xEB, address, 0xE7, 0x0E, data1,... data14, checksum | Data1: FOLLOWENCYRPT_MONITOR; <ul style="list-style-type: none"><li>• 0 = decryption, 1 = encryption</li></ul> Data2: RESOLUTION_INDEX; <ul style="list-style-type: none"><li>• from 0x00 to 0x17 (24 resolutions)</li></ul> Data3: PATTERN_INDEX; <ul style="list-style-type: none"><li>• from 0x00 to 0x1f (32 patterns)</li></ul> Data4: DEEPCOLOR_MODE; <ul style="list-style-type: none"><li>• 0 = auto, 0x18 = 24bit, 0x1e = 30bit, 0x24 = 36bit</li></ul> Data5: COLORSPACE_MODE; <ul style="list-style-type: none"><li>• 0 = auto, 1 = RGB444, 2 = YUV444, 3 = YUV422</li></ul> Data6: reserved <ul style="list-style-type: none"><li>• 0 = auto, 1 = 44k, 2 = 48k, 3 = 88k, 4 = 96k, 5 = 176k, 6 = 192k</li></ul> Data8: AUDBIT_INDEX; <ul style="list-style-type: none"><li>• 0 = auto, 0x10 = 16bit, 0x14 = 20bit, 0x18 = 24bit</li></ul> Data9: AUDCHANNEL_INDEX; <ul style="list-style-type: none"><li>• 0 = auto, 1 = turn off, 2 = 2channels .....,8 = 8channels</li></ul> Data10: BITRATE_INDEX; <ul style="list-style-type: none"><li>• 0 = auto, 1 = 1.62G, 2 = 2.7G</li></ul> Data11: OUT_LANE_INDEX; <ul style="list-style-type: none"><li>• 0 = auto, 1 = 1, 2 = 2, 4 = 4 (channels)</li></ul> Data12: OUT_ENHFRAMING_INDEX <ul style="list-style-type: none"><li>• 0 = auto, 1 = not supported, 2 = supported.</li></ul> Data13: OUT_DELAY; <ul style="list-style-type: none"><li>• 0 = 0ms, 1 = 200ms, 2 = 400ms, 3 = 600ms, 4 = 800ms, 5 = 1000 (ms)</li></ul> Data14: training result; <ul style="list-style-type: none"><li>• 0 = fail, 1 = succeed</li></ul> |

8.3.6     Get Output Status when the Device is in Auto Mode

| Command | Send/Receive                                                                                              | Data (Auto Setup)                                                           | Data (Not Auto Setup)                                                           |
|---------|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| 0xE7    | 0xEB, address, 0xE7, 0x01, 0x01, checksum<br><br>0xEB, address, 0xE7, 0x08, data1, ....., data8, checksum | data1: Deep Color: 0x18 (24bit), 0x1E (30bit), 0x24 (36bit)                 | Setup value                                                                     |
|         |                                                                                                           | data2: Color Space: 1 = RGB444, 2 = YUV444, 3 = YUV422                      | Setup value                                                                     |
|         |                                                                                                           | data3: Audio sample: 1 = 44k, 2 = 48k, 3 = 88k, 4 = 96k, 5 = 176k, 6 = 192k | Setup value                                                                     |
|         |                                                                                                           | data4: Audio bit: 0x10 (16), 0x14 (20), 0x18 (24)                           | Setup value                                                                     |
|         |                                                                                                           | data5: Audio channel number                                                 | If setup is auto: 2-8 channels<br>If setup is not auto: setup value             |
|         |                                                                                                           | data6: Bit Rate                                                             | If setup is auto: 1=1.62G, 2=2.7G<br>If setup is not auto: setup value          |
|         |                                                                                                           | data7: Lane Number                                                          | If setup is auto: 1, 2, 4<br>If setup is not auto: setup value                  |
|         |                                                                                                           | data8: Enhanced Framing                                                     | If setup is auto: 1=Not support, 2=Support<br>If setup is not auto: setup value |

8.3.7     Get Monitor Status

| Command | Send/Receive                                                                                              | Data                                                                                                                                                                                                                                                                                   |
|---------|-----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0xE8    | 0xEB, address, 0xE8, 0x01, 0x00, checksum<br><br>0xEB, address, 0xE8, 0x08, data1, ....., data8, checksum | data1: reserved<br>data2: reserved<br>data3: reserved<br>data4: monitor type (0 = DVI, 1 = HDMI)<br>data5: monitor HDCP status. (0 = no HDCP support, 1 = HDCP supported)<br>data6: monitor Deep Color status (24/30/36)<br>data7: Load status. (0 = no HPD, 1=HPD)<br>data8: reserved |

8.3.8     Set Monitor Status

| Command | Send/Receive                                                                                              | Data                                                                                                                                                                                                                                                                                                                                 |
|---------|-----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0xE9    | 0xEB, address, 0xE9, 0x01, 0x00, checksum<br><br>0xEB, address, 0xE9, 0x08, data1, ....., data8, checksum | data1: monitor Color Space status: 0 = RGB, 1 = YUV422, 2 = YUV444, 3 = YUV444+422<br>data2: reserved<br>data3: reserved<br>data4: monitor Bit Rate status: 1 = 1.62G, 2 = 2.7G<br>data5: monitor Lane status: 1, 2, 4<br>data6: monitor Enhanced framing status: 1 = Not support, 2 = Support<br>data7: reserved<br>data8: reserved |

8.3.9 Set Detailed Timing for User-defined Resolution

| Command | Send/Receive                                                                                                                                                                                                                                                      | Data                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0xEA    | 0xEB, address, 0xEA, 0x26, [block index],<br>[perform immediately], data1H_4bits,<br>data1L_4bits, data2H_4bits, data2L_4bits, .....,<br>data17H_4bits, data17L_4bits, data18H_4bits,<br>data18L_4bits, checksum<br><br>0xEB, address, 0xEA, 0x01, 0xFA, checksum | 1. [block index]: From 0 to 7<br><b>Note:</b> 7 is the preferred timing of the monitor, so it is preferable to use 0 to 6<br>2. [perform immediately]: 1 = switch to the user-defined resolution immediately, 0 = save the user-defined resolution but do not switch<br>3. "H_": high bits<br>4. "L_": low bits<br>5. "data nH_4bits" and "data nL_4bits": As, 0xfa apart to 0x0f and 0x0a<br>6. The 18 data are the detailed timing of the EDID.<br><br>Example 1: 1600*1200*60 VESA DMT-10<br>Frame of Command as: EB 90 EA 26 00 00 04 08 03 0F 04 00 03 00 06 02 0B 00 03 02 04 00 04 00 0C 00 01 03 00 00 06 0F 01 03 01 01 00 00 00 00 01 0E (00)<br><br>Example 2: 720p<br>Frame of Command as: EB 90 EA 26 00 00 00 01 01 0D 00 00 07 02 05 01 0D 00 01 0A 02 00 06 0E 02 08 05 05 00 00 07 0E 08 08 04 02 00 00 00 00 01 0A (00) |

8.3.10 Get Detailed Timing for the User-defined Resolution

| Command | Send/Receive                                                                                                                                                                                                                                  | Data               |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| 0xEA    | 0xEB, address, 0xEA, 0x01, data1, checksum<br><br>0xEB, address, 0xEA, 0x26, block index, 00,<br>data1H_4bits, data1L_4bits, data2H_4bits,<br>data2L_4bits, ....., data17H_4bits,<br>data17L_4bits, data18H_4bits, data18L_4bits,<br>checksum | data1: From 0 to 7 |

8.3.11 Setting a Predefined Resolution as a User-defined Resolution

| Command | Send/Receive                                                                                              | Data                                                                                                                                                                                                                              |
|---------|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0xEA    | 0xEB, address, 0xEA, 0x03, data1, data2, data3, checksum<br><br>0xEB, address, 0xEA, 0x01, 0xFA, checksum | data1: block index: from 0 to 7<br>data2: perform immediately: 0 = save the user-defined resolution but do not switch, 1 = switch to the user-defined resolution immediately<br>data3: predefined resolution number, from 0 to 35 |

8.3.12 Get the Monitor EDID

| Command | Send/Receive                                                                                                                                                                                                                                  | Data                                                                                                                                             |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| 0xFD    | 0xEB, address, 0xFD, 0x02, 0x03, 0x00, checksum<br><br>0xEB, address, 0xFD, 0x12, 0x03, [group num],<br>data1H_4bits, data1L_4bits, data2H_4bits,<br>data2L_4bits, ....., data7H_4bits, data7L_4bits,<br>data8H_4bits, data8L_4bits, checksum | [group num]: from 0 to 0x3f. Each group has 8 bytes of EDID data<br><br>When sending the command, there are 64 groups for 512 bytes of EDID data |

8.3.1    Get the Monitor DPCD

| Command | Send/Receive                                                                                                                                                                                                                               | Data                                                                                                                                                                                                                                                                                                                                                                                      |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0xFD    | 0xEB, address, 0xFD, 0x02, 0x05, data1, (check sum)<br><br>0xEB, address, 0xFD, 0x12, 0x05, [data num], data1H_4bits, data1L_4bits, data2H_4bits, data2L_4bits, ....., data7H_4bits, data7L_4bits, data8H_4bits, data8L_4bits, (check sum) | data1:<br>0: Receiver Capability Field<br>1: Link Configuration Field<br>2: Link / Sink Status Field<br>3: Source Device Specific Field<br>4: Sink Device Specific Field<br>5: Branch Device Specific Field<br>6: Sink Control Field<br><br>[data num]: from 0 to 0x1f. Every group has 8 bytes DPCD data<br><br>When sending the command, there are 32 groups for 256 bytes of DPCD data |

8.3.2    Reset Device

| Command | Send/Receive                                                |
|---------|-------------------------------------------------------------|
| 0xED    | 0xEB, address, 0xED, 0x04, 0x03, 0x01, 0x02, 0x07, checksum |
|         | 0xEB, address, 0xED, 0x01, 0xFA, checksum                   |

**LIMITED WARRANTY**

We warrant this product free from defects in material and workmanship under the following terms.

**HOW LONG IS THE WARRANTY**

Labor and parts are warranted for seven years from the date of the first customer purchase.

**WHO IS PROTECTED?**

Only the first purchase customer may enforce this warranty.

**WHAT IS COVERED AND WHAT IS NOT COVERED**

Except as below, this warranty covers all defects in material or workmanship in this product. The following are not covered by the warranty:

- Any product which is not distributed by us or which is not purchased from an authorized Kramer dealer. If you are uncertain as to whether a dealer is authorized, please contact Kramer at one of the agents listed in the Web site [www.kramerelectronics.com](http://www.kramerelectronics.com).
- Any product, on which the serial number has been defaced, modified or removed, or on which the WARRANTY VOID IF TAMPERED sticker has been torn, reattached, removed or otherwise interfered with.
- Damage, deterioration or malfunction resulting from:
  - Accident, misuse, abuse, neglect, fire, water, lightning or other acts of nature
  - Product modification, or failure to follow instructions supplied with the product
  - Repair or attempted repair by anyone not authorized by Kramer
  - Any shipment of the product (claims must be presented to the carrier)
  - Removal or installation of the product
  - Any other cause, which does not relate to a product defect
  - Cartons, equipment enclosures, cables or accessories used in conjunction with the product

**WHAT WE WILL PAY FOR AND WHAT WE WILL NOT PAY FOR**

We will pay labor and material expenses for covered items. We will not pay for the following:

- Removal or installations charges.
- Costs of initial technical adjustments (set-up), including adjustment of user controls or programming. These costs are the responsibility of the Kramer dealer from whom the product was purchased.
- Shipping charges.

**HOW YOU CAN GET WARRANTY SERVICE**

- To obtain service on you product, you must take or ship it prepaid to any authorized Kramer service center.
- Whenever warranty service is required, the original dated invoice (or a copy) must be presented as proof of warranty coverage, and should be included in any shipment of the product. Please also include in any mailing a contact name, company, address, and a description of the problem(s).
- For the name of the nearest Kramer authorized service center, consult your authorized dealer.

**LIMITATION OF IMPLIED WARRANTIES**

All implied warranties, including warranties of merchantability and fitness for a particular purpose, are limited in duration to the length of this warranty.

**EXCLUSION OF DAMAGES**

The liability of Kramer for any effective products is limited to the repair or replacement of the product at our option. Kramer shall not be liable for:

- Damage to other property caused by defects in this product, damages based upon inconvenience, loss of use of the product, loss of time, commercial loss; or:
- Any other damages, whether incidental, consequential or otherwise. Some countries may not allow limitations on how long an implied warranty lasts and/or do not allow the exclusion or limitation of incidental or consequential damages, so the above limitations and exclusions may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights, which vary from place to place.

**NOTE:** All products returned to Kramer for service must have prior approval. This may be obtained from your dealer.

This equipment has been tested to determine compliance with the requirements of:

- EN-50081: "Electromagnetic compatibility (EMC); generic emission standard.  
Part 1: Residential, commercial and light industry"
- EN-50082: "Electromagnetic compatibility (EMC) generic immunity standard.  
Part 1: Residential, commercial and light industry environment".
- CFR-47: FCC\* Rules and Regulations:  
Part 15: "Radio frequency devices  
Subpart B Unintentional radiators"

**CAUTION!**

➤ Servicing the machines can only be done by an authorized Kramer technician. Any user who makes changes or modifications to the unit without the expressed approval of the manufacturer will void user authority to operate the equipment.

➤ Use the supplied DC power supply to feed power to the machine.

➤ Please use recommended interconnection cables to connect the machine to other components.

\* FCC and CE approved using STP cable (for twisted pair products)

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CAMBOARD Electronics



For the latest information on our products and a list of Kramer distributors, visit our Web site where updates to this user manual may be found.

**We welcome your questions, comments, and feedback.**

Web site: [www.kramerelectronics.com](http://www.kramerelectronics.com)

E-mail: [info@kramerel.com](mailto:info@kramerel.com)



**SAFETY WARNING**

Disconnect the unit from the power supply before opening and servicing